REMARKS/ARGUMENTS

Reconsideration of this application is respectfully requested in view of the foregoing amendments and discussion presented herein.

1. Interview with Examiner on July 28, 2008.

Applicant appreciated the opportunity to discuss the question of the TCP header field with the Examiner (and the other two Examiners) during the interview. The discussion answered the question of what the Examiner was 'asserting' to be explicit back-to-back indications in the TCP header, as nothing of this nature was found defined in the TCP header. In discussing this it was found that packet sequence numbering and packet fragmentation controls were being considered as indications of back-to-back sending. According to that discussion, Applicant has included a discussion of these aspects, and has amended the claims toward removing any confusion between the back-to-back nature of packets as recited in the pending claims and the nature of packet sequence numbering and fragment control techniques.

2. Rejection of Claim 13 under 35 U.S.C. §112, second paragraph.

Examiner indicated that the rejection of Claim 13 was not addressed and thus has not been withdrawn.

Claim 13. Dependent Claim 13 was amended in the prior response to correct an antecedent issue found by Applicant (nothing was specified). Applicant apologizes that the amendment toward overcoming the 112 rejection was omitted from the list of the claims amended per the 112 rejection. In particular, said means was recast to assure proper antecedent basis with parent Claim 1, explicitly reciting "*explicitly marking packets, in the sender*". Additionally, Claim 13 is currently amended to amend "*a sender*" to "*the sender*" thus assuring that it is the sender described in Claim 13 and in Claim 1 that is being referred to. If any further issue remains in this regard, it would be beneficial that the Applicant be apprised of specific details.

Therefore, the rejection of Claim 13 should be withdrawn.

3. Discussion in "Response to Arguments".

Before proceeding to discuss the particulars of the shortcomings of the obviousness rejection, Applicant addresses issues which were brought forth in the "Response to Arguments" section of the Office Action which discussed the arguments put forth in the prior response, and in view of the interview discussed above.

The Examiner's contentions regarding obviousness are based on equating sequence numbering and/or fragmentation control with the explicit back-to-back packet marking recited herein. In section 50 of the present action, discussing Claim 1, the Examiner contends that the combination comports with the recited claim as follows: "*…packets are indicated as being sent back-to-back by initially unsetting the **indication bit** in the TCP header field, such that they are marked as back-to-back by default*."

The Examiner, however, never cites WHAT INDICATION BIT. It is further stated that "*Furthermore, applicant argues that by contrast, NONE of the cited references are directed to control congestion in response to these packet trains. However, by definition, packet fragmentation means that the packets are not homogenous. Therefore, by not marking the packets, they are recognized as being homogenous.*" Here we see the argument posited which appears to connote a relationship between packet trains and some unspecified understanding of "homogeneous" as relating to the sequence. It seems it is being asserted that packets which are not marked are apparently part of different packet sequences (non-homogenous) - however, as will be discussed, this is not the definition of "back-to-back" within a packet sequence. The argument does not bear on the obviousness of the explicit back-to-back packet marking.

Although the Office Action does not specify which bits were being referred to "*in the TCP header*", the interview cleared this up as being considered the packet sequence, and/or bits relating to fragmentation, although the Examining group did not elucidate any specific bits in this regard.

Sequence and Fragmentation Versus Explicit Back-to-Back Marking

This section provides background information describing fundamental differences to aid the discussion and understanding between sequence numbering and fragmentation control in relation to the explicit back-to-back marking by the sender as recited in the present invention.

Before proceeding to discuss fragmentation, the topic of packet sequence number is discussed, as the use of fragmentation can only be properly understood in the context of packet sequencing.

Description of Sequence Numbering.

In order to assure that packets are reassembled in the proper order at the destination, despite being received out of order, such as losing their order with respect to being subject to different delays and paths, a packet sequence number is relied upon. Consider the example of numbering packets as 0, 1, 2, 3, 4, …9; wherein at the destination it can be readily determined how to reorder the packets for use according to their sequence number. **It will be noted, however, the sequence number provides NO information as to whether or not these packets were sent within the same packet train, or burst**, only that they are sent within the same sequence. (definition of back-to-back is that they are in the same packet train with no inter-packet gap ("ipg") between respective packets) - discussed later on.

A problem then arises with ordering the packets when a packet must be broken up (fragmented) as it traverses the network. It should be noted that not all portions of a network support the same MTU (maximum transport unit - packet core), wherein packets can be broken up "fragmented" without any knowledge of this fragmentation by the original sender. In considering an example of each incoming packet being split into two packets at some point along the transmission path, consider the reception of packets with sequence numbers 2, 1, 2, 1, 0, 0, 3, 4, 3, 4, …8, 8, 9, 10, 9, according to the previous packet sending example described above. How then does the receiver

discern how to assemble these packets? In addition, how does the receiver know when it can begin re-assembling a packet, unless it knows if any more fragments exist? How would the receiver know where to position the bits of each fragment in relation to the prior fragment? Accordingly, packet fragmentation is controlled using fragment fields within the TCP header to respond to these problems.

Description of Fragmentation Control.

Attached is a document entitled "What is a Packet Fragment" from the site www.tech.faq.com. "Fragmentation", as relating to the control of packet fragmentation across a network and, in particular, the flags and fragment offset fields in a packet header, is also a specific term of art which should not be confused with the ordinary use of the term "fragment", as meaning simply to divide something.

As described above, fragments arise when a packet sent by a first network device (sender) with a first MTU size, must be broken up by a second, third or *n*th network device as that packet is communicated toward its final destination. In particular, fragmentation information is conveyed via a set of flags, and a fragment offset. Three flag bits are contained here in the Internet protocol: Bit0 - always set to 0; Bit1 - 0=you may fragment the packet, 1=you may not fragment the packet; Bit2 - 0=last fragment, 1=more fragments coming. The fragment offset is a 13 bit offset value (typically octet value) describing where the fragment fits into the original datagram (packet) in terms of bytes divided by 8 (octets). It should be appreciated that "fragmentation" of this nature is not performed by the sender when it divides incoming data, or data stream, into a series of packets. Unfortunately, the original application speaks of fragmentation in some places in its non-art meaning of "to divide" when discussing the generation of the original packet; it was not considered that any confusion could arise with regard to the technical use of "fragmentation" as generated downstream within the network as the originally sent packets are 'repackaged' into fragments. The specification is amended herein to replace the word "fragment" with

"divide" as seen in paragraph [0009] toward removing any such source of confusion.

It will be noted that the fragmentation and its field information is not generated by the first sender, but that this additional information is added to the header as the packet traverses the network and becomes fragmented out of necessity. It should also be noted that **fragmentation has nothing to do with whether these packets were sent with an inter-packet gap by the original sender** (ergo - fragmentation does not relate to the question of back-to-back sending of the packets in the original packet train).

We have clearly seen that neither Packet Sequence Number fields nor Fragmentation fields provide ANY indication of whether the packets were sent back-to-back, - - they only provide a specification of order for the packets and fragments of segments, respectively.

Description of Back-to-Back Packet Sending.

The term "back-to-back" in the context of the instant application is a particular term of art that is well known in the art, thus the original application did not provide a tutorial on the meaning of what constitutes "back-to-back" packets. Even in normal parlance it would be incorrect to consider that sequential packets within any stream of packets are of necessity "back-to-back", because when the back of one thing is against the back of another, there is nothing in-between - **no gap**. Analogously, the cars connected in a diesel powered train are coupled to one another - if a gap exists between the couplers of one car and the next, then the cars are not in the same train. Even the dictionary uses phrases like: "*adjacent or contiguous*", "*one following immediately after the other*", "*unbroken sequence*", and "*consecutive*" (Webster's Encyclopedic Unabridged Dictionary ©1996).

In the art, the term "back-to-back" is a term indicating that a group of packets, typically referred to within a burst or packet train, are sent directly "one after another in sequence" (as described in paragraph [0009] of the specification), and thus without any inter-packet delay. The lack of delay between back-to-back packets is described in

paragraph [0071] of the instant application: "*For example, relying solely on such back-to-back packet estimates by the receiver is inherently inaccurate and error prone, because the sending unit 110 might delay packet transmissions for various reasons.*" Consequently, the packets within a single burst are sent without any inter-packet delays, such as overhead, sending of other sequences, ACKS, and the like.

It should also be noted that the packets in a packet train **even when sent back-to-back, can be received with inter-packet gaps** in response to receipt by a local network that is faster than the uplink. In considering this, it will be appreciated that no downstream receivers can accurately ascertain whether packets were originally sent "back-to-back".

It is also well known that different network systems have differing abilities to process packets "back-to-back"; that is to process a sequence of packets which arrive without any inter-packet gap between each packet of the given sequence. A typical parameter referring to this ability is "*pace-size*", such as from 1-256 packets, which specifies the capability of the system as per how many packets can be sent out from the system without an interpacket gap. *[This is a system parameter, not to be confused with a packet or packet train bit - this is not contained in packet headers, and does not specify whether specific packets being sent back to back.]* In view of this, we see that "back-to-back" is a defined characteristic of different systems.

Accordingly, we see that indicating that packets are sent "back-to-back" is more than just indicating that the packets are within the same sequence of packets, because there are often delays between the sending of each packet within a sequence of packets. In fact a full ACK cycle can be performed between each packet within a sequence, even with a full handshake delay between packets, while the packets are still in the same sequence. In addition, we also see that "back-to-back" is not determined in relation to the order of packets within a sequence, or a datagram.

Advantages of "Back-to-Back" Packet Sending.

The background of the invention (paragraphs [0009] and [0014]-[0022]) discusses the throughput advantages of sending packet trains and the difficulties which arise using conventional methods of bandwidth estimation in receiver-side TCP congestion control and controlling the length of packet trains. Packet trains can be sent without the ACK overhead for each of the packets, which is a clear advantage toward reduced overhead. Packets within a "train" are directly coupled to one another with no intervening gaps, just as the various boxcars, flatcars and reefers in a cargo train connect together and are pulled by the same locomotive.

The object of the invention, as recited in the transitional last paragraph of the background is "*for providing a robust and accurate form of bandwidth estimation for use in performing receiver-side TCP congestion control, and for controlling the length of packet trains*." The bandwidth estimates in the present invention are enhanced by "*explicitly marking each packet that is being sent back-to-back (alternatively inverse marking logic can be less preferably utilized)*" (see paragraph [0027]), "*wherein error-prone receiver side 'estimating' of back-to-back packets is unnecessary*" (paragraph [0062]). The text goes on to describe two alternate means of performing the explicit marking of back-to-back packets.

Distinction of Explicit Marking of "Back-to-Back" Packets within a Packet Train.

It should be recognized from the above discussion that neither Sequence Number, nor Fragmentation Control fields specify whether the respective packets were originally sent with any inter-packet delay. Both of these sets of fields specify the order of packets and subpackets, while the flags field of fragmentation control bits can only indicate if the packets *can* be fragmented and if any more fragments are forthcoming. **There is nothing in these fields which provide any indication of whether the packets are sent in a back-to-back manner.** It is with the above discussion in mind that the specific claims of the instant application are discussed.

4. Rejection of Claims 1-8, 10-17, 22-32, and 36-39 under 35 U.S.C. § 103(a).

Claims 1-8, 10-17, 22-32, and 36-39 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Yoshimura et al. (U.S. Patent No. 6,125,397), hereinafter 'Yoshi', in view of Brown et al. (U.S. Patent No. 7,266,613) hereinafter 'Brown' and further in view of Samuels et al. (U.S. Appl. Publ. No. 2005/0005024 A1) hereinafter 'Samuels.

(a) Claim 1. Independent Claim 1 is directed to a system for controlling network congestion.

In support of the rejection, Examiner considers Yoshimura (Yoshi) as teaching a system for controlling network congestion, and Brown teaching the sending of packets "*back-to-back*". It should be appreciated, before proceeding, that it is well known that packets can be sent "back-to-back" and thus without interpacket delay. It is also known that many systems have tried to control network congestion. However, the objects and operating principles of the present invention are directed as a means for explicitly marking at a sender which packets of a sequence are sent "back-to-back", and using that explicit information from the sender for controlling network congestion. These aspects of the instant application are clearly distinct from the teachings of the cited references.

Examiner admits that Yoshi in view of Brown "*does not teach explicitly indicating which packets are being sent back-to-back*". Examiner asserts that "*Sam teaches a system indicating packets based off of their status ([0146] & [0147]), in Sam's case the status indicated is packet fragmentation that implies the packets are being sent sequentially*." Examiner goes on toward supporting why the combination of Sam (Samuels) with Yoshi and Brown would be obvious.

However, a number of problems exist with support for the rejection. It should first be appreciated that the instant application operates according to different objects and operating principles than the cited references.

Although packets are often sent sequentially, or even back-to-back within a

sequence of a conventional TCP systems, one of the problems being met in the present invention relates to controlling network congestion in response to packet trains (bursts) sent from sender to receiver. The claimed invention provides for controlling network congestion on the basis of "*explicitly indicating which packets within the sequence of packets are being sent back-to-back*" as recited in Claim 1. The cited references do not provide any teachings for this aspect of the invention.

The back-to-back aspect of the present invention which is recited in the claims is described in paragraph [0009] of the instant application: "*A data object to be sent is divided into a sequence of packets. Typically the packets are sent sequentially based on their position in the original data object. When sequential packets are communicated one after another in sequence they are referred to as being "back-to-back" packets, since they are sent in a single burst and the sequence is not broken by the communication of other forms of packets, such as according to retransmitting in response to packet errors. If sufficient bandwidth exists larger numbers of packets should be sent back-to-back.*" By contrast, NONE of the cited references are directed to control congestion in response to explicit indications of which packets were sent within these packet trains of "back-to-back packets".

The Yoshimura (Yoshi) reference describes conventional recovery-type congestion control as seen in its abstract: "*A data transfer apparatus and method uses recovery-type congestion control and avoidance-type congestion control. A bandwidth determination unit determines requested bandwidth for a congestion avoidance-type data transfer in accordance with control information communicated between applications prior to the congestion avoidance-type data transfer.*" The Examiner indicates Yoshimura (Yoshi) doesn't teach packets being sent back-to-back. It should be recognized that Yoshimura (Yoshi) provides no control of the extent to which packets are sent back-to-back, or of marking packets sent back-to-back.

The Brown reference describes "*Fast Dynamic Measurement of Bandwidth in a TCP Network Environment*" as found in the title of that reference. Examiner refers to

back-to-back packet sending in Col. 5, lines 23-30 and Col. 6, lines 31-40.

In Col. 5, lines 23-30 of Brown a technique called "*packet-pair*" is referred to as follows: "*With packet-pair, two identical packets are sent back-to-back. The server sends a pair of packets, one immediately after the other. Both packets are identical; thus they have the same size (PS). The bandwidth is determined by dividing the packet size by the time difference in reception of each packet.*" First, it is seen that the use of "*packet-pairs*" are used as a bandwidth measurement with two identical packets being used. These marker packets are identical and identifiable, thus the packet-pair does not comprise packets within a sequence of packets as recited in Applicant claims. In addition, since packet trains are admittedly known with strings of packets being sent "back-to-back", the Brown reference provides nothing of relevance. Brown does not teach any mechanism for a sender marking of which packets have been sent "back-to-back" with no delay between successive packets.

In Col. 6, lines 31-40 of Brown, the "*packet-pair*" is expanded with multiple packets being sent and speed calculated for each. Again the discussion is about estimating bandwidth in response to speed determinations of the packets. The estimations are performed at the receiving end. Although Brown provides an estimation method, it is a method which lacks the accuracy of the explicit back-to-back packet marking recited in the present invention, and clearly does not comport with the teachings of the present invention.

Brown provides no teaching relating to determining which packets are sent back-to-back, and more particularly of explicitly marking those packets as being sent back-to-back by the sender.

Towards overcoming the deficiencies with these references, the Samuels (Sam) reference is combined with Yoshimura and Brown. The Samuels reference is a "*Method of Determining Path Maximum Transmission Unit*" (PMTU), or path MTU, as recited in the title of the invention. Samuels discusses the use of a performance-enhancing proxy (PEP) (paragraph [0014]) with the object of the invention described in

paragraph [0027] of the Samuels reference, as: "*Consequently, a new method of deploying PEPs is required to efficiently integrate them into a network. These PEPs must supply algorithms that remove the performance limitations inherent in TCP implementations.*" The Summary of the Samuels invention in paragraph [0028] describes the invention as: "*<u>A method of detecting the maximum transmission unit of a path between two performance enhancing proxies is disclosed</u>.*" The summary concludes by describing the mechanism by which the value of PMTU is altered: "*Upon arrival, the downstream proxy determines if <u>fragmentation</u> of the packets has occurred. The downstream proxy notifies the upstream proxy of the determination. The upstream proxy uses the notification from the downstream proxy to retain, revert or alter the new estimated PMTU.*" (emphasis added)

The cited paragraphs [0146] and [0147] within Samuels are consonant with the above in describing notification of the upstream PEP in response to detecting "*fragmentation*". From the discussion earlier discussion of sequence number and fragmentation control, it will be recognized that this has no relationship to a sender explicitly marking packets as being sent "back-to-back": (1) no explicit marking, (2) not a sender based function, (3) determining split up of packets as they traverse network, no indication of whether delays in between packets wherein it does not relate to whether even fragments are received "back-to-back, and so forth. Paragraph [0146] states: "*The receiving PEP observes the arrival of packets. If the receiver detects the arrival of a <u>fragmented packet</u>, then the receiver reports back to the sender that fragmentation is occurring, by marking the ACK packet that is generated for the received packet.*" (emphasis added) In view of the above it is clear that fragmentation is not related to disruptions in the back-to-back train of packets, but is in response to receipt of a packet fragment (an error, or the breakup of a packet traversing the path) instead of a whole packet. This is why there is no mechanism described for detecting the "fragments", because receivers are already configured to determine if received packets are whole and correct. This understanding is borne out in other parts of Samuels as follows.

In paragraph [0112] Samuels describes the meaning of "*fragmentation*": "*As described above, TCP performance is proportional to packet size. Thus increasing packet sizes improves performance unless it causes substantially increased packet loss rates or other nonlinear effects, like IP fragmentation. In general, wired media (such as copper or fiber optics) have extremely low bit-error rates, low enough that these can be ignored. For these media, it is advantageous for the packet size to be the maximum possible before fragmentation occurs (the maximum packet size is limited by the protocols of the underlying transmission media).*"

It can be recognized from the above that Samuels is not discussing anything relating to a sender explicitly marking packets which are sent back-to-back, but only of communicating the receipt of packet fragments by the receiver back to the sender to determine the maximum transmission unit (MTU) value to be used to size the packets. It will be readily appreciated that determining whether one has a partial packet is entirely different than detecting the extent to which intact packets are being received sequentially "back-to-back" as they were sent out without delays between these packets.

More pointedly, as mentioned Samuels does not teach any "*means for explicitly indicating which packets within said sequence of packets are being sent back-to-back*". Thus, combining Samuels with the other references still provides no teaching for aspects of the invention recited in the claim.

Accordingly, as the Samuels reference in combination with the Yoshimura and Brown and what is known to one of ordinary skill in the art does not result in the invention as recited in Claim 1, wherein a lack of support exists for the rejection of Claim 1.

Furthermore, Applicant has amended Claim 1 to recite what is meant by "back-to-back" in the sequence of packets as: "*means, within said device, for sending packets of a sequence in a back-to-back nature, wherein back-to-back packets are packets which are communicated, with no delay between the back of one packet and beginning*

of the next packet, one after another in a single burst within the sequence of packets." (underlining showing the most recent amendment). The amendment thus inculcates what is in the specification about "back-to-back" packet trains, toward eliminating any possible improper speculations thereto.

Therefore, the above shows that the combination of references does not provide any teaching, suggestion, or motivation for that which is recited in the claims of the instant application and does not render the claims obvious. Applicant respectfully requests that the rejection of Claim 1, and the claims which depend therefrom, be withdrawn.

(b) Claim 14. Independent Claim 14 is directed to a system for controlling network congestion.

Support for the rejection follows that which was given in regard to Claim 1 discussed above.

As discussed in relation to Claim 1, the elements of Claim 14 describe "*marking packets, in a sender, to explicitly indicate if they are sent back-to-back*". Examiner admits that Yoshimura and Brown provide no such teachings, wherein the teaching of detecting "*fragments*" by Samuels is relied upon.

However, as already discussed in relation to Claim 1, Samuels does not explicitly mark any packets, prior to sending, with an indication of whether they are being sent back-to-back. In addition, the detection of fragmentation by Samuels has been shown to detect packet fragments which does not comport to indicating the extent to which packets are being sent back-to-back.

Furthermore, Applicant has amended Claim 14 to recite "back-to-back" packet sending as: "*sending packets of a sequence in a back-to-back nature in a single burst in which there is no delay between the back of one packet and the beginning of the next packet*" (underlining showing the most recent amendment). The amendment thus manifests the essence from the specification about what "back-to-back" packet trains are all about, toward eliminating improper speculations.

Accordingly, the combination of the cited references in view of what is known in the art does not provide teaching, suggestion, or motivation for the aspects of the invention as recited in Claim 14. Therefore, the Applicant respectfully requests that the rejection of Claim 14, and the claims that depend therefrom, be withdrawn.

(c) Claim 26. Independent Claim 26 is directed to a system for controlling network congestion.

Support for the rejection follows that which was given in regard to Claims 1 and 14 discussed in prior sections.

In like manner to the traversal of the rejection of Claims 1 and 14, the elements of Claim 26 similarly describe "*estimating network bandwidth in response to receipt of explicit indications of back-to-back packets or utilizing back-to-back packet estimations*". Examiner admits that Yoshimura and Brown provide no such teachings, wherein the teachings of detecting "fragments" within Samuels are relied upon.

However, as already discussed in relation to Claims 1 and 14, Samuels neither explicitly marks any packets, nor does it determine back-to-back packet estimations, as required by the claim. As discussed already, the detection of fragmentation by Samuels has been seen to detect packet fragments which do not relate to the extent to which packets are sent back-to-back, but only that the packet lengths are excessive.

Furthermore, Claim 26 recites "*sending packets of a sequence in a back-to-back nature in a single burst in which there is no delay between the back of one packet and the beginning of the next packet," and "explicit marking of packets which are sent back-to-back*" for which no comparable teachings from the references are put forth in support of the rejection. It should be appreciated that none of the references provide any mechanism whatsoever for explicit marking of back-to-back packets for use in controlling the length of packet trains, but only for controlling the size of the packets being sent, which of course are two distinct forms of network control.

Accordingly, the combination of the cited references in view of what is known in the art does not provide teachings, suggestion, or motivation for the aspects of the

invention as recited in Claim 26. Therefore, the Applicant respectfully requests that the rejection of Claim 26, and the claims that depend therefrom, be withdrawn.

(d) Claim 27. Independent Claim 27 is directed to a method of using bandwidth estimation to improve TCP congestion control.

Support for the rejection follows that which was given in regard to Claims 1, 14 and 26 discussed in prior sections.

The traversal of the rejection of Claim 27 follows similarly that of Claims 1, 14 and 26, as the elements of Claim 27 similarly describe *"marking each packet, explicitly, that is being sent back-to-back, from a sender, to a receiver"* and "*estimating bandwidth in response to receiving packets from other senders which are explicitly marked as back-to-back packets*". Examiner admits that Yoshimura and Brown provide no such teachings of bandwidth estimates, wherein the teachings of detecting "fragments" within Samuels are relied upon, which does not comport with the use of the explicitly marked back-to-back packets.

As already discussed in relation to Claims 1, 14 and 26, Samuels neither explicitly marks any packets, nor does it determine back-to-back packet estimations, as required by the claim. As discussed already, the detection of fragmentation by Samuels has been seen to detect packet fragments which bears no relationship to the extent to which packets are sent back-to-back, but only that the packet lengths are excessive for a given portion of the network being traversed.

Furthermore, Claim 27 recites "*wherein packets of a sequence are in a back-to-back nature when sent in a single burst in which there is no delay between the back of one packet and the beginning of the next packet"* for which no comparable teachings from the references are put forth in support of the rejection. It should be appreciated that none of the references provide any mechanism whatsoever for explicit marking of back-to-back packets for use in controlling the length of packet trains, but only for controlling the size of the packets being sent, which of course are two distinct forms of network control.

Accordingly, the combination of the cited references in view of what is known in the art does not provide teachings, suggestion, or motivation for the aspects of the invention as recited in Claim 27. Therefore, the Applicant respectfully requests that the rejection of Claim 27, and the claims that depend therefrom, be withdrawn.

(e) Claims 2-13, 15-25, and 28-39. Claims 2-13, 15-25, and 28-39 depend from claims whose patentability has been demonstrated, thus these dependent claims should be considered *a fortiori* allowable in view of their respective base claims.

However, a number of these claims provide additional distinctions which have not been fully appreciated in the Office Action. The following claims are discussed by way of example.

Claim 2. In support of the rejection the sequence numbering described in paragraph [0148] of Samuels is relied upon in conjunction with the teachings of Yoshimura and Brown.

Yoshimura and Brown clearly provide no teaching in relation to estimating the number of back-to-back packets and in particular using that information in combination with explicit back-to-back packet indications. However, the teachings of paragraph [0148] of Samuels also lacks such teaching and provides further support that the operating principles of Samuels does not relate to registering and controlling packet trains at all, but with reducing packet sizes in response to receipt of packet fragments. A portion of paragraph [0148] is as follows.

> *"The active PMTU discovery algorithm operates by increasing the MTU of transmitted packets until a fragmentation indication is received, signaling that the PMTU has been exceeded. Because of the time lag between the sending of a larger packet and the reception of the ACK for it, as well as the use of cumulative ACKs, the PMTU discovery algorithm operates with imprecise information. In a preferred embodiment, the PMTU discovery algorithm increases the size of packets slowly, so as to reduce the uncertainty. The PMTU for a connection is increased by a few percent once for every RTT that elapses without a fragmentation indication. In a preferred embodiment, the sequence number of the first packet with an increased RTT is recorded. If that sequence number is ACKed without a fragmentation indication (either specifically or cumulatively), then the algorithm assumes that the PMTU for that packet is acceptable and*

increases it, again recording the sequence number." (emphasis added)

It is apparent that no *"means for estimating the number of back-to-back packets received within a receiver from said sender and utilizing that information in conjunction with the explicit back-to-back packet information*" is provided by the Samuels reference. RTT is the Round-Trip Time estimation for which each sequence of packets is timestamped. This mechanism can not be equated with an explicit marking that packets within a sequence of packets were sent back-to-back.

Therefore, support is lacking for the rejection of dependent Claim 2, and the rejection should be withdrawn.

Claim 4. In support of the rejection it is asserted that the tracking of sequence numbers by Samuels comports to this aspect of the invention, while aspects of Yoshimura and Brown are not discussed.

As has been discussed, neither Samuels or any of the other references teaches the use of an explicit back-to-back packet indication from a sender, indicating that packets were sent without any inter-packet delay. Thereby it makes no sense to assert that Samuels teaches a back-to-back estimate used "*for checking the presence and validity of explicit back-to-back indications from the sender*", as recited in Claim 4.

Therefore, support is lacking for the rejection of dependent Claim 4, and the rejection should be withdrawn.

Claim 8. In support of the rejection, the modulating of header information by Samuels is asserted as recited in paragraphs [0147] and [0148].

Yoshimura and Brown are not brought forth in support as they clearly provide no teaching in relation to setting of header bits based on back-to-back status.

However, the Samuels reference also lacks teaching which comports to this aspect of the invention. The cited paragraphs describe marking the ACK packet in the receiver in response to detecting packet fragments.

Claim 8 is directed at marking of packet header bits indicating back-to-back status prior to transmission of those packets.

Therefore, as these have no correlation to that which is asserted for the cited references, then the rejection of Claim 8 should be withdrawn.

Claim 13. Similar to Claims 8 and 9, none of the cited references describe "*marking packets according to whether or not they are being sent back-to-back*". Obviously, Yoshimura and Brown provide no such teachings. The cited Samuels reference detects the receipt of packet fragments and communicates this back to the sender to control MTU value, nothing is put forth for marking packets being sent in relation to whether they are being sent back-to-back. Again, we reiterate that packet sequence number and fragmentation fields do not provide any indication of whether packets are sent back-to-back and thus without any intervening delays between each packet sent by the sender.

Therefore, these references provide no teaching, suggestion or motivation, either separately, or in combination with each other or what is known in the art, wherein they do not support the obviousness rejection. Applicant respectfully requests that the rejection of Claim 13 be withdrawn.

Many of the remaining dependent claims suffer from shortcomings similar to those brought out above. In addition, all these dependent claims are progeny of claims whose patentability has been demonstrated wherein they should be considered *a fortiori* allowable.

5. Rejection of Claims 9, 18-21, and 33-35 under 35 U.S.C. § 103(a).

Claims 9, 18-21, and 33-35 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Yoshi, Brown and Samuels as applied to Claims 1, 14, and 27 above, and further in view of Huang et al. (U.S. Appl. Publ. No. 2003/0103453 A1) hereinafter Huang.

Claims 9, 18-21, and 33-35 depend from claims whose patentability has been demonstrated, thus these dependent claims should be considered *a fortiori* allowable in view of their respective base claims.

However, as each of these claims provide additional distinctions which have not been fully appreciated in the Office Action, they are discussed in the following.

<u>Claim 9</u>. Similar to Claim 8 discussed previously, Claim 9 recites a mechanism using modulation of the MSS for explicitly indicating back-to-back status of a packet prior to its transmission. Yoshimura and Brown clearly provide no teachings of explicit back-to-back packet indications. In addition, it has been shown that the detection of packet fragments within a receiver by the Samuels reference, also does not comport to indicating back-to-back status prior to transmission.

The rejection asserts that Samuels "*does not disclose modulating the setting of the maximum segment size (MSS) for indicating back-to-back status of packets being transmitted*". In putting forth the combination with Huang it is asserted that "*Huang teaches modulating the setting of the maximum segment size (MSS) for indicating back-to-back status of packets being transmitted [0068].*"

However, Applicant finds no support of this assertion in paragraph [0068] of Huang, nor can Applicant find support anywhere in the Huang reference regarding explicitly indicating back-to-back packets being transmitted, such as recited within the base claims of the instant application.

Instead the Huang reference is directed to a time-division queue rate control scheme as seen in the Abstract of that invention, a portion of which reads as follows.

> "*The TDQ-RCS according to the present invention can rapidly determine departure time of an arrival packet, add the arrival packet into the time division queue to which it belongs according to the departure time, and then output the packet on schedule.*"

It will be seen that the above discusses registering departure time and not whether packets are sent back-to-back - thus by definition it is not an explicit reference - as the nature of the packets can only be inferred from the timing based on the receiving

end trying to guess at parameters such as speed, original packet sizing, and so forth from the original sender prior to changes which arise during communication, such as fragmentation of the packets within the packet sequence. Although no discussion was found in Huang for using these timestamps to determine the back-to-back relationship of packets, the background of the instant application in paragraph [0020]-[0021] discusses shortcomings of timestamp evaluation approaches which attempt to do so.

In any case the Huang reference can not be said to provide the explicit marking of back-to-back packets being transmitted. One can see from paragraph [0068] that Huang partitions upstream and downstream traffic.

> *"According to the present invention, a packet transmitted by the sender in the low rate direction will be partitioned into a series of smaller packets, if the payload size of the packet is larger than the legal rate predetermined for said traffic stream based on said QoS information. To achieve such partition, an optional header, Maximum Segment Size (MSS), of the TCP is employed in the present invention. The MSS is to set the largest payload size of the TCP traffic stream."*

In relation to the above it will be seen that the Huang reference, considered either separately, or in combination with the other cited references and what is known in the art, could not provide proper support for an obviousness rejection of these dependent claims.

Therefore, the rejection of Claim 9 should be withdrawn.

Claim 18. Claim 18 contains a recitation of using the changes in MSS to explicitly mark back-to-back packets being sent in the manner of Claim 9 above, but directed to base Claim 14.

Therefore, the rejection of Claim 18 should be withdrawn.

Claim 19. Dependent Claim 19 is rejected on the basis of changing packet sizes to "*improve the data for corresponding to available bandwidth*". However, this characterization misses critical distinctions brought out in Claim 19 and its parent claim. In particular modulation of packet size is used as recited in Claim 19 as the explicit

indication that packets are being sent back-to-back. The cited references change packet length to accomplish direct objectives in response to fragmentation (Samuels) or bidirectional packet flow (Huang), yet there is no support given from these references that of modulating the MSS based on each packet being back-to-back with another packet prior to sending. Thus, in the claims of the instant application packet size was not changed as the object, or goal, but as an indication, or flag, which is used for allowing the length of packet trains to be increased.

Therefore, the rejection of Claim 19 should be withdrawn.

Claims 20-21. Claims 20-21 contain further definitions of how the MSS is modulated as an explicit indicator of a packet that is sent back-to-back, and thus these claims are not obvious for the same and additional reasons as given in regard to Claim 19.

Therefore, the rejection of Claims 20-21 should be withdrawn.

Claims 33-35. Claims 33-35 depend from independent Claim 27, and recite modulation of the MSS as an explicit indicator of a packet that is sent back-to-back, in a manner as recited in dependent Claim 18, which depended from independent Claim 14. For those same reasons, Claims 33-35 are not obviated by the teachings of Huang, in combination with Samuels, Brown, Yoshimura, and what is known in the art.

Therefore, the rejection of Claims 33-35 should be withdrawn.

Therefore, each of the above dependent claims should be considered *a fortiori* allowable in view of dependence from a base claim shown to be non-obvious, while each dependent claim provides further grounds for non-obviousness in relation to all the cited references, including Huang, and what is known in the art.

6. Amendment of Specification.

Paragraphs [0013], [0015], and [0059] of the specification have been amended to reduce any confusion between the term of art “fragment” and the non-art term “fragments” with regard to simply dividing an input.

Support for "dividing" the packets is seen in paragraph [0009]. The word fragment here could be easily confused with the process of dividing packets after they are sent by the sender during routing through network segments, wherein it has been appropriately changed in view of the context.

7. Amendments to Claims 1, 13-14, and 26-27.

Claims 1, 14, and 26-27. The independent claims within the instant application have been amended to recite with greater particularity what is meant by "back-to-back" packets, wherein the explicit marking of "back-to-back" packets can be better understood.

The claims recite the "back-to-back nature" of the packet train, support for which is found in paragraphs [0026], [0043]-[0044] and so forth. Additionally, the claims spell out that back-to-back packets are communicated with "no delay" between the back of one packet and the beginning of the next packets, support for which is found in the specification at paragraphs [0021], [0071] and so forth.

In particular the specific claims were changed as follows.

Claim 1 was amended as "*means, within said device, for sending packets of a sequence in a back-to-back nature, wherein back-to-back packets are packets which are communicated, with no delay between the back of one packet and beginning of the next packet, one after another in a single burst within the sequence of packets.*"

Claim 14 was amended to include: "*sending packets of a sequence in a back-to-back nature in a single burst in which there is no delay between the back of one packet and the beginning of the next packet.*"

Claim 26 was amended to include: "*sending packets of a sequence in a back-to-back nature in a single burst in which there is no delay between the back of one packet and the beginning of the next packet*" and "*explicit marking of packets which are sent back-to-back*."

Claim 27 was amended to include: "*wherein packets of a sequence are in a back-to-back nature when sent in a single burst in which there is no delay between the back of one packet and the beginning of the next packet*."

Claim 13. Dependent Claim 13 has been amended to change "*a sender*" to read "*the sender*" to provide a proper antecedent. Additionally, the explicit marking phrase is amended to recite the lack of delay between packets as "*explicitly marking packets, in the sender, according to whether or not they are being sent back-to-back without delays between successive packets.*", support for which was given in relation to Claim 1.

8. Amendments Made Without Prejudice or Estoppel.

Notwithstanding the amendments made and accompanying traversing remarks provided above, Applicant has made these amendments in order to expedite allowance of the currently pending subject matter. However, Applicant does not acquiesce in the original ground for rejection with respect to the original form of these claims. These amendments have been made without any prejudice, waiver, or estoppel, and without forfeiture or dedication to the public, with respect to the original subject matter of the claims as originally filed or in their form immediately preceding these amendments. Applicant reserves the right to pursue the original scope of these claims in the future, such as through continuation practice, for example.

9. Request for Continued Examination (RCE).

An appropriate fee is enclosed for a RCE (Request for Continued Examination) of this application (See 37 CFR 1.114).

10. Conclusion.

Based on the foregoing, Applicant respectfully requests that the various grounds for rejection in the Office Action be reconsidered and withdrawn with respect to the presently amended form of the claims, and that a Notice of Allowance be issued for the present application to pass to issuance.

In the event any further matters remain at issue with respect to the present application, Applicant respectfully requests that the Examiner please contact the undersigned below at the telephone number indicated in order to discuss such matter prior to the next action on the merits of this application.

Date: August 28, 2008

Respectfully submitted,

John P. O'Banion, Reg. No. 33,201
M. Robyn Carrillo, Reg. No. 47,474
Rodger H. Rast, Reg. No. 45,853
O'BANION & RITCHEY LLP
400 Capitol Mall, Suite 1550
Sacramento, CA 95814
(916) 498-1010

Attachment: Paper Entitled - “What is a Packet Fragment”

Excerpt from www.tech-faq.com (search for fragmentation)

What is packet fragmentation?

Every packet-based network has an MTU (Maximum Transmission Unit) size. The MTU is the size of the largest packet which that network can transmit.

Packets larger than the allowable MTU must be divided into multiple smaller packets, or fragments, to enable them to traverse the network.

Network	Standard MTU
Ethernet	1500
Token Ring	4096

Packet Headers

Every IP packet has an IP (Internet Protocol) header which stores information about the packet, including:

- Version
- IHL
- Type of Service
- Total Length
- Identification
- Flags
- Fragment Offset
- Time to Live
- Protocol
- Header Checksum
- Source Address
- Destination Address
- Options

Note: For more information on the IP header, see RFC 791 - Internet Protocol.

Three of these fields are involved in packet fragmentation.

- Identification
- Flags
- Fragment Offset

Identification: 16 bits

An identifying value assigned by the sender to aid in assembling the fragments of a datagram.

Flags: 3 bits

Various Control Flags.

Bit 0: reserved, must be zero
Bit 1: (DF) 0 = May Fragment, 1 = Don't Fragment.
Bit 2: (MF) 0 = Last Fragment, 1 = More Fragments.

```
  0   1   2
+---+---+---+
|   | D | M |
| 0 | F | F |
+---+---+---+
```

Fragment Offset: 13 bits

This field indicates where in the datagram this fragment belongs.

The fragment offset is measured in units of 8 octets (64 bits). The first fragment has offset zero.

Much like the IP header, the TCP (Transmission Control Protocol) header stores information about the packet:

- Source Port
- Destination Port
- Sequence Number
- Acknowledgement Number
- Data Offset
- Flags
- Window
- Checksum
- Urgent Pointer
- Options
- Padding

Note: For more information on the TCP header, see RFC 793 - Transmission Control Protocol.

A Packet Fragmentation Example

If a 2,366 byte packet enters an Ethernet network with a default MTU size, it must be fragmented into two packets.

The first packet will:

- Be 1,500 bytes in length. 20 bytes will be the IP header, 24 bytes will be the TCP header, and 1,456 bytes will be data.
- Have the DF bit equal to 0 to mean "May Fragment" and the MF bit equal to 1 to mean "More Fragments."
- Have a Fragmentation Offset of 0.

The second packet will:

- Be 910 bytes in length. 20 bytes will be the IP header, 24 bytes will be the TCP header, and 866 bytes will be data.
- Have the DF bit equal to 0 to mean "May Fragment" and the MF bit equal to 0 to mean "Last Fragment."
- Have a Fragmentation Offset of 182 (Note: 182 is 1456 divided by 8).

The Packet Fragmentation Attack

Packet fragmentation can be utilized to get around blocking rules on some firewalls.

This is done by cheating with the value of the Fragment Offset. The trick is to set the value of the Fragment Offset on the second packet so low that instead of appending the second packet to the first packet, it actually overwrites the data **and** part of the TCP header of the first packet.

Let's say you want to `telnet` into a network where TCP port 23 is blocked by a packet filtering firewall. However, SMTP port 25 is allowed into that network.

What you would do is to send two packets:

The first packet would:

- Have a Fragmentation Offset of 0.
- Have the DF bit equal to 0 to mean "May Fragment" and the MF bit equal to 1 to mean "More Fragments."
- Have a Destination Port in the TCP header of 25. TCP port 25 is allowed, so the firewall would allow that packet to enter the network.

The second packet would:

- Have a Fragmentation Offset of 1. This means that the second packet would actually overwrite everything but the first 8 bits of the first packet.

- Have the DF bit equal to 0 to mean "May Fragment" and the MF bit equal to 0 to mean "Last Fragment."
- Have a Destination Port in the TCP header of 23. This would normally be blocked, but will not be in this case!

The packet filtering firewall will see that the Fragment Offset is greater than zero on the second packet. From this data, it will deduce that the second packet is a fragment of another packet and it will not check the second packet against the rule set.

When the two packets arrive at the target host, they will be reassembled. The second packet will overwrite most of the first packet and the contents of the combined packet will go to port 23.